MARCH
1970

45¢

Live Steam

HOME STEAMERS AND LARGE-SCALE MODEL RAILROADERS

in this issue

Shop Tips

Steam Meets

Construction

Live Steam
magazine

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COVER PHOTO

Jack Kerr of Winnipeg, Manitoba, makes a final adjustment to his 3½" scale Hudson on the transfer table at Al O'Neil's track in Lake City, Minnesota, during the Southern Minnesota Live Steamer Association's Meet in October. Photo by H. E. Brakke.

SUBSCRIPTIONS: $4.50 per year in U. S. A. and Canada (U. S. Funds), $5.50 per year (U. S. Funds) in other countries.

SUBMISSIONS of material for publication are considered to be made gratis unless the contributor so specifies in his letter.

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PUBLISHED MONTHLY by William C. Fitt, 1285 North Twenty-Seven Road, Cadillac, Michigan 49601. Phone 616 – 775-6296

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LIVE STEAM
Post Office Box 635
Cadillac, Michigan 49601

SECOND CLASS POSTAGE PAID AT CADILLAC, MICHIGAN

Neither Rain, nor Snow . . .

nor any of those other meteorological phenomena that you have heard about will keep Live Steamers from making their rounds of a track.

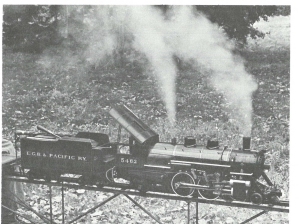
The weather was terrible. Rain and snow and cold . . . but Live Steamers came from far and near and enjoyed it anyway.

From Cincinnati, Ohio, came Gregory Korner, Robert Maynard with his 4–4–2, Russ Conley with his 4–6–4 and Jim Aull with his Maine Two-Footer. Bill Grecko came up from St. Louis, Missouri. Jack Kerr and Paul Winslow brought Jack's 4–6–4 down from Winnipeg, Manitoba. Lester Glass with his 4–6–4 and P. G. "Scotty" Scott and Clint Elliott drove up from Iowa. Don Strom had his 2–8–4, Hue Brakke his 4–6–2, Fred Harvey had his 4–4–2, Al O'Neil his 4–8–4 and Don Akens brought his 1" scale 4–4–2 to represent the host club, the Southern Minnesota Live Steamer Association, on the weekend of October 11th and 12th.

Al O'Neil provided the half-mile track for running and operated his 2" gauge Atlantic as well. Russ Conley provided Saturday Night Movies with Walt Disney's "Great Locomotive Chase" and the talk was (if you will pardon the expression) all steam!

By 3:30 on Sunday afternoon, though, the weatherman took over and the cold, heavy rain brought the running to a halt. Live Steamers loaded their cars, turned on the heaters and windshield wipers and headed for home — hoping to return again and give that half-mile track a real workout.

Report by Richard Winkle
Photos by Hue Brakke



Russ Conley's 4–6–4 (across page, top) voices impatience to get rolling as a last minute adjustment is made, and Bill Goesch takes a turn around the track (bottom) with Jack Kerr's Hudson from Winnipeg. Bob Maynard's trim-looking Atlantic (this page, top) kicked up her heels a long way from home track in Cincinnati. Al O'Neil administers valve oil (center) to his 12" gauge Atlantic as Richard Winkle, Bob Ahrens, Jim Machacek and his son (l to r) look on. Al's 12" gauge equipment, including three 4–4–0's (bottom) are all stored for the winter — waiting to breath new life and excitement with the return of spring.

SCREW THREADS for the apprentice

by Jack D. McKenty

One hundred fifty years ago in England, when an engineering firm started to manufacture a new piece of equipment, the first part they made was a "screw plate." This was a plate with various threads machined into holes in it and was used to make all the bolts and screws for that particular piece of equipment. When the new machine was delivered, the screw plate went with it, in case repairs were ever needed.

This meant that the bolts and screws were special for that machine. Not only were standards different between various engineering firms, but even between different pieces of equipment made by a single firm.

This wasn't good, but it was tolerable when bolts were made one at a time. With advances in tooling, it became more economic to make bolts and screws in big batches, and each large firm then adopted its own standards for all its manufactured items. Small companies could buy bolts cheaper from large firms than they could make them themselves, and the standards spread.

The British "Whitworth" thread is named after the man who was most successful in having his company's standards adopted by others. For general engineering purposes, that is. Various special industries adopted their own standards for their own purposes, so in England "standard" threads now include British standard fine, British standard pipe, British cycle threads (for bicycles), British standard brass, and B. A. or British Association threads.

Model Engineer Magazine even proposed a special set of threads for model making. These M. E. threads have spread to a surprising degree in British industry and appear in some handbooks.

In America things were a little better. "National Standard" threads were adopted fairly early. They were, of course, quite different from Whitworth, and the U. S. also had all sorts of special purpose threads, including machine screw and iron pipe threads.

There were, and still are, many ultra-special threads, some of which are international. These include the Edison threads, for light bulbs (different in Europe), threads for bottle closures, sheet metal screws, and optical and watchmaking threads.

The rest of the world was on the metric system but even metric standards differ between countries.

The chaos became acute in World War II, when equipment made in the United States was being repaired in England. A special commission proposed the "Unified" threads, the theory being that both countries would switch to the same system.

If the war had lasted longer, say another twenty-five years, the switch might have been made. As it is, Great Britain and North America now pretty well agree as to the number of threads per inch for a given size bolt, but the form of the thread is still different in each area, and a bolt from one will not fit a nut from the other.

England is now committed to change to the metric system. What this will do to the B.A. and M.E. threads so widely used by British modelers is not yet known. For modelers, the confusion is going to get worse again.

It is obvious that a *complete* set of taps and dies to cut all the threads in all the systems would cost more

Screw Threads

Table I – National Coarse

Thread	O.D.	Clear	Tap
1 - 64	.0730	48	53
2 - 56	.0860	43	50
3 - 48	.0990	38	46
4 - 40	.1120	33	43
5 - 40	.1250	30	38
6 - 32	.1380	28	35
8 - 32	.1640	19	29
10 - 24	.1900	11	24
12 - 24	.2160	7/32	16
1/4 - 20	.2500	F	13/64
5/16 - 18	.3125	O	G
3/8 - 16	.3750	V	O
7/16 - 14	.4375	29/64	V
1/2 - 13	.5000	33/64	27/64

Table II – National Fine

Thread	O.D.	Clear	Tap
00 - 90	.0470	55	63
0 - 80	.0600	1/16	3/64
1 - 72	.0730	48	53
2 - 64	.0860	43	50
3 - 56	.0990	38	46
4 - 48	.1120	33	42
5 - 44	.1250	30	37
6 - 40	.1380	28	32
8 - 36	.1640	19	29
10 - 32	.1900	11	21
12 - 28	.2160	7/32	14
1/4 - 28	.2500	F	3
5/16 - 24	.3125	O	I
3/8 - 24	.3570	V	Q
7/16 - 20	.4375	29/64	25/64
1/2 - 20	.5000	33/64	29/64

than a new lathe. It is necessary to be selective.

The suggestion has been made that before starting a project the beginner should study the plans and make a list of all the screw and bolt sizes involved, and then purchase the equipment for those sizes. Very good, but if the first project is a Stuart stationary engine (which is an excellent first project), all the threads will be B.A. and M.E., which will not help when the time comes to build an American loco. Your own set of standards should be determined as early as possible.

My suggestion is that you buy, as you need it, the equipment to make threads from the accompanying tables – I, II, III and V. I am *not* recommending that you obtain all the tools to make all the threads.

The machine screw sizes are the small ones starting with a number (1–64, 2–56, etc.).

In Table II, the National Fine machine screw sizes are given mostly for your information. They are not recommended, chiefly because bolts and screws in those sizes are difficult to obtain. This is unfortunate. The N.F. machine screws look better on small models, are stronger, size for size, and are less likely to unscrew with vibration. The true devotee thinks nothing of making a batch of NF bolts if he needs them, and I don't think very much of it either! I'd rather buy them, and this means National Coarse (from Little Engines, Sierra Swiss, Cole's, Friends, etc.).

The larger NF sizes are a little different. Many of these sizes are used in making parts, rather than bolts and screws, and if the plans call for them, by all means use them.

The tiniest NF machine screws (0–80 and 00–90) are another exception, since National Coarse doesn't go down that small, and they may be needed on small models. The 00–90 is an unofficial size, but the tools for it are obtainable.

Table I, National Coarse, lists the common workhorse sizes that are used for almost everything. Both the tools and the fasteners (i.e. the bolts, screws and nuts) are commonly available and you will probably end up with a fairly complete set of taps and dies in NC.

Table III is N.S. which means National Standard, but which is usually referred to as National Special. Some sizes from this table come closest to duplicating the Model Engineer threads, all of which are either 32 or 40 threads per inch. The sizes were "Standard" until Unified came along. Now the tools for these sizes are seldom used commercially, and may be very expensive from industrial supply houses. Our suppliers handle them reasonably priced.

Not given in any table are the fractional sizes below ¼". These are usually not recommended since they don't do anything machine screw sizes don't do, and fasteners in these sizes are next to impossible to obtain. Little Engines carries taps and dies in these sizes. Maybe they know something I don't know.

Table IV is also for your information. It shows the nearest equivalent NC size for all the common B.A. sizes, as found on British plans. Note that NF sizes would in most instances be closer yet, but unless you like making your own fasteners . . .

Table V gives the sizes for Cole's Model Taper Pipe threads. These threads are mostly unofficial, but supplement in small sizes the standards of the American iron-pipe threads. The 5/16 M.T.P. is identical with the 1/16" iron-pipe size, but try and find 1/16" iron-pipe equipment.

They have the same degree of taper as do the full-size pipe taps and dies and the same advantage of making leak-proof pipe joints with a minimum of effort. Since pipe-fittings in these sizes are also obtainable, it means that a small locomotive can have pipe work that looks proportionate. They are the one thing that our English cousins have reason to be jealous about. Paradoxically, the tools are made in England for Cole's Power Models.

The columns in each table giving the tap and clearance drill sizes are so the tables do not have to be reproduced next month when "Thread Cutting" will be discussed.

Screw Threads

Table III – National Standard

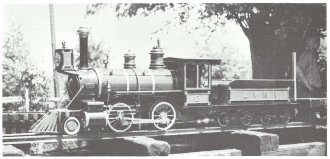
Thread	O.D.	Clear	Tap
1 - 56	.0730	48	54
4 - 32	.1120	33	45
4 - 36	.1120	33	44
5 - 36	.1250	30	40
6 - 36	.1380	28	34
8 - 30	.1640	19	30
8 - 40	.1640	19	28
10 - 28	.1900	11	23
10 - 30	.1900	11	22
12 - 32	.2160	7/32	13
1/4 - 24	.2500	F	4
1/4 - 27	.2500	F	3
1/4 - 32	.2500	F	7/32
5/16 - 20	.3125	O	17/64
5/16 - 27	.3125	O	J
5/16 - 32	.3125	O	9/32
3/8 - 20	.3750	V	21/64
3/8 - 27	.3750	V	R
7/16 - 24	.4375	29/64	X
1/2 - 12	.5000	33/64	27/64
1/2 - 24	.5000	33/64	29/64
1/2 - 27	.5000	33/64	15/32

Table IV – B.A. or British Association Equivalents

B.A.	Approx. T.P.I.	O.D.	Clear	Tap	Nearest N.C.
0	25.4	.2360	B	8	1/4 - 20
1	28.2	.2087	3	16	12 - 24
2	31.4	.1850	3/16	5/32	10 - 24
3	34.8	.1614	19	29	8 - 32
4	38.5	.1417	27	32	6 - 32
5	43	.1260	30	27	5 - 40
6	47.9	.1102	33	43	4 - 40
7	52.9	.0984	38	46	3 - 48
8	59.1	.0866	43	50	2 - 56
9	65.1	.0748	48	53	1 - 64
10	72.6	.0669	50	55	0 - 80
11	81.9	.0591	53	56	N.F.
12	90.9	.0511	55	60	00 - 90 N.F.

Table V – Model Taper Pipe

Thread	O.D.	Tap
1/8 - 56	.125	42
5/32 - 48	.156	30
3/16 - 40	.187	23
1/4 - 40	.250	5
5/16 - 27	.312	F



WM. C. FITT

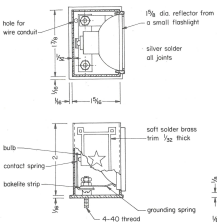
The author's RARITAN on the steaming track at the Pennsylvania Live Steamers facilities in Paoli, Pennsylvania.

building the RARITAN

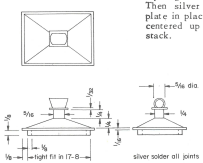
by William H. Morewood

The Headlight Assembly (17–8) uses a reflector obtained from a flashlight that uses "C" size batteries.

The Headlight Bracket (17–10) may be lined up by first making up the two brackets and arms. Bolt them to the smokebox and see that the two top edges are parallel to the frame. Then silver solder the 1/16" thick plate in place, making sure that it is centered up relative to the smokestack.

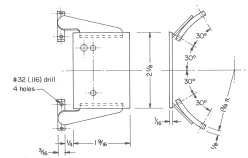


17-8 HEADLIGHT ASSEMBLY
Brass - 1 required

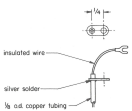


17-9 HEADLIGHT COVER
Brass - 1 required

headlight



17-10 HEADLIGHT BRACKET
Brass - 1 required



17-11 WIRE CONDUIT
1 required

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1969

VOLUME THREE

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Published by

William C. Fitt
Post Office Box 635
Cadillac, Michigan 49601

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NORTH EASTERN OHIO LIVE STEAMERS
Club Organized Nov. 13
Live Steam Club Forming July 11
NORTHERN ILLINOIS LIVE STEAMERS
First Run Dec. 13
New Club Officers June 13
Novy, Bud June 3, Dec. 13
Nuskey, Elmer, Jr. July 12
NUTTING, WAYNE
Obituary May 13

OLD #3
Headed for Winter Quarters Mar. 6
OMAHA AREA LIVE STEAMERS
Battle at the Boilers May 8
O'Neil, Al July 12
ONTARIO SUNPARLOR LINES
Big Steamup Planned Jan. 6
New Track in Windsor Sept. 4

Park, Halsted, Jr. Dec. 12
PATTEPOOL
Deposit Increased Apr. 10
Issues Longer List Jan. 6
Peck, Douglas Jan. 4
Penrod, Ernest May 7
PENSACOLA LIVE STEAMERS
Enter Second Year Jan. 5
PERE MARQUETTE'S PACIFICS
Class P—1 (4701—705) Oct. 2
Class SP (4706—710) Nov. 2
Class SP—2 (725—729) Dec. 4
Phillips, Mrs. Thomas C. Feb. 2
PHILLIPS, THOMAS C.
Fall Meet in Charlotte Feb. 2
Pieper, Ray Aug. 3
PILOT
building the RARITAN Feb. 8
PILOT TRUCK
building the RARITAN Jan. 9
PIONEER VALLEY LIVE STEAMERS
Elect Officers July 12
Fall Meet Dec. 12
Pollard, M. D. "Snub" July 5
Pugh, John Aug. 9
PUMP
Axle Pump Oct. 5
Crosshead Pump Sept. 10
Tender Hand Pump (RARITAN) June 9
Tender-mounted Hand Pump Sept. 9
Puriton, Charles A. "Carl" Feb. 3

RAIL
Still No Steel Rail Sept. 11
RARITAN
(See MOREWOOD, WILLIAM H.)
Ridenour, James Dec. 3
Ritch, Orice Feb. 1, 2, 3
Ritenburg, Gilbert June 12
Robinson, Stanley June 3
Roehm, Charles, Jr. Dec. 13
Roehm, Charles, Sr. Dec. 13
ROTARY SNOW PLOW
Fighting the Blizzards Jan. 2
Royal Hudsons Aug. 4
Russell, Dan May 3

SACRAMENTO VALLEY LIVE STEAMERS
Newest Live Steam Club Dec. 12
Schaub, Nick June 3
SCOCCY, G.
Fall Meet in Iowa Iowa Spring Meet July 4
Scott, T. R. Feb. 5
Scott, Wally Dec. 9
Scott, William Dec. 10
Sheets, James May 7
SILVER SOLDERING
Warning issued Feb. 4
Sigveland, Dr. Ivan, Jr. July 12
Sixth Annual Exposition of Steam Sept. 11
Smith, Larry Jan. 4
Smith, Rex Sept. 4
SMOKEBOX
Raritan Fittings Mar. 9
SMOKE STACK
Raritan Apr. 4
So You Want To Build A Live Steam Locomotive
(See NELSON, JOSEPH F.)
SOUTHERN MINNESOTA LIVE STEAMERS
Fall Meet Sept. 7
Half-in Track for 3/4" Scale Up 12
Steam Film Library Progressing May 12
SOUTHERN VALVE MOTION Apr. 12
SOUTHERN WISCONSIN LIVE STEAMERS
Fall Meet in Charlotte Feb. 2
STAINLESS STEEL BOILERS OK Jan. 10
Steam-Powered Wrecking Crane Aug.
STEAM RAILROAD RESTORATION SOCIETY
Fighting the Blizzards Jan. 2
Steam-Powered Wrecking Crane Aug. 7
STEPHENSON VALVE GEAR
Jan. 7, Feb. 7
Still No Steel Rail Sept. 11
STOLZENFELS, RICHARD
Re-Creates a Maine Two-Footer Mar. 2
SULLIVAN, GEORGE
Obituary July 11
Sullivan, Tom Sept. 4

Tedder, Joel May 12
Tedder, Mike May 12
TENDERS
So You Want To Build A Live Steam Locomotive Dec. 7
TEXAS LIVE STEAMERS
First Texas Live Steam Meet Sept. 8
Third Annual Live Steam Club Survey Oct. 8
THOMPSON, R. E. "BOBBY"
Obituary Sept. 11
Thompson, R. E. "Hobby" (4—6-4) May 1
THOMSEN, ERICH
Crickett July 2
Three-Phase Power for your Shop Feb. 9
TILDEN, SOUTH GATE & PACIFIC RAILWAY
Crickett July 2
TRI-STATE LOCOMOTIVE CLUB
Michigan Club Expanding July 11
Michigan Steam Locomotive Meet May 12
New Steam at Meet Aug. 9

TUBES
More Date on Tube Size Aug. 14
Thoughts on Tube Size June 14
Turnbull, James Dec. 9

ULRICH, CARL
Brass Lantern Award Sept. 2
Ulrich, Carl June 3
UNION PACIFIC RAILROAD
Centennial Celebration
May 10th Feb. 5
"U.P. Story" Available Apr. 10

VALVE GEAR
So You Want To Build A
Live Steam Locomotive
Allan Straight Link Mar. 7
Baker Valve Motion May 5
Gooch Motion Mar. 7
Hackworth Motions Apr. 11
Joy Valve Motion Apr. 12
Marshall Valve Motion Apr. 11
Southern Valve Motion Apr. 11
Stephenson Valve Gear
Jan. 7, Feb. 7
Walschaerts Valve Motion June 5
Young Valve Motion Aug. 10
Vezolia, Frank May 12
VITKOVITS, STEPHEN, JR.
Third Annual Live Steam
Club Survey Oct. 8

WALSCHAERTS VALVE
MOTION June 5
WEGNER, ARTHUR
Obituary May 13
WHEEL GUARDS
Raritan Mar. 9
Whitaker, Ray (4–6–4) July 5
Whitmer, A. H. (2–6–0) Apr. 8
Whittum, Sanford Feb. 6
Williams, Russell Aug. 9
Wilson, Robert Apr. 3
Winkle, Richard Sept. 7
Wischstadt, Ace (2–6–0) May 7
Wright, James Feb. 6

Yates, L. L. Sept. 8
YODER, ENOS W.
New Year's Celebration –
Florida Style Jan. 4
Young, Norman Nov. 13
Young, Ted (4–8–8–4, 2–6–0) July 5
YOUNG VALVE MOTION Aug. 10

ZIMMER, WILLIAM
Brass Lantern Award Sept. 2
Zimmer, William June 3

INSPECT UNUSUAL STEAM

New Jersey Live Steamer members took two short trips during December to see steam "where it is"; according to a report by Walt Kleinfelder.

The first was to St. George, Staten Island, where they boarded the ferryboat *Marry Murray* and toured her engine and boiler rooms. The 4,000 HP double compound engines, 225½" & 50 ½"-59", were most impressive.

The second trip was to Newark to visit the operating rooms of three steam highway swing bridges, said to be the last in the State of New Jersey. Each has two boilers and the engines in an engine room up over the roadway. Two had double vertical engines and the third has a double horizontal engine, all beautifully kept. They are fired with anthracite coal. These two enjoyable trips were arranged by NJLS Member, Richard Russell.

If you plan to attend the BROTHERHOOD OF LIVE STEAMERS' Meet in Los Angeles on May 29, 30 and 31, please fill in this coupon or send the requested information to:

JOEL CORBIN
17723 Kittridge Street
North Hollywood, California 91606

Number and type of equipment you will bring:

Locomotives:___ Gauge: 7½"___ 4-1/4"___ 3½"___

Tractions___ Stationary:___ Other:(list)___

NAME

Will you have static display? Yes:___ No:___

ADDRESS

Will you need display table? Yes:___ No:___

Size and weight of display:___

CITY STATE ZIP

If you wish to reserve a camper or trailer space, please give type and size of vehicle.

Number Date:
In Party ___ Attend 29 30 31

Make motel reservations early. Following have TV, Phone, Air Conditioning, AAA approved, credit cards honored. Please contact them direct.

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TOLUCAN MOTEL, 3910 Riverside Dr., Burbank CA 91505 Phone 213-845-9517 $11.00 up

YOUR PATTERNS IN THE PATTERN POOL?

Even if you have finished your Live Steam locomotive and at this time don't intend to start another, there's some food for thought in donating a copy of the Pattern Pool's list of patterns. Send a quarter with a self-addressed #10 (business size) envelope and 12¢ postage to the Live Steam Pattern Pool, 962 Greenland Road, Portsmouth, N. H. 03801 and see if you don't agree.

You will see that a whole bunch of Live Steamers have gone through that very procedure -- built their engines, and then donated their patterns to the Pattern Pool so that other Live Steamers can have a wider selection of prototype material to work from. Some, who like to keep the originals of their handy-work have donated aluminum copies for use in the Pattern Pool.

How about your patterns? Could another Live Steamer make good use of them? Walter Allen handles the whole operation by storing, cataloging and keeping track of patterns that are sent out to be used by others. He gets absolutely nothing for his service (the $10 deposit is returned less only postage or other direct expense when the patterns are returned in good order) and has made it possible for hundreds of Live Steamers to build an engine not otherwise available on the market. Walt can even arrange to get the castings made and shipped if a Live Steamer has no access to a local foundry.

Who knows . . . in looking over the list of patterns available, you might even see the possibility of building another engine without the need for additional pattern work.

Send for your copy now.

April

10 **MID-SOUTH LIVE STEAMERS**
11 7½" gauge
12 Austin F. Barr, Jr. track
Junction of Highways 1 and
214 at Whitehall
Route 2
Harrisburg, Arkansas 72432

18 **FLORIDA LIVE STEAM MEET**
19 7½" Gauge, LA.L.S Standards
E. J. Pavitt
501 Northlake Boulevard
North Palm Beach, Florida

May

15 **PIONEER VALLEY LIVE**
16 **STEAMERS**
17 Branton W. Bantfather, Secy.
3 Fleetwood Drive
Sandy Hook, Conn. 06482

29 **BLS NATIONAL MEET**
30 Los Angeles Live Steamers
31 Griffith Park
3½"—4¼" — 7½" gauges
Joel Corbin, Secretary
12723 Kittridge Street
North Hollywood, CA 91606

29 **PENNSYLVANIA LIVE**
30 **STEAMERS**
31 2½" - 3½" - 4¼"
William M. Scott, Secy.
R. D. 1, Box 400
Sellersville, Pa. 18960

June

5 **NEW JERSEY LIVE**
6 **STEAMERS**
7 Advance registration required
3½" — 4¼" — 7½"
Ralph W. Green, Secy.
845 Kilsyth Road
Elizabeth, N. J. 07208
Phone 201 — 353-4424

6 **IOWA MODEL STEAM**
7 **ENGINEERS**
3½" — 4¼" — 7½" gauges
Pershing D. Scott
R.F.D. 1
Marion, Iowa 52302

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Menlo Park, Calif. 94025
Phone 415 — 325-4209

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Harry F. Haas
Route 1, Box 47A
Jamul, California 92035

LOS ANGELES LIVE STEAMERS
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Joel Corbin, Secretary
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North Hollywood, Calif. 91606

MONTREAL LIVE STEAMERS
1st Sunday of each month
2½" — 4¼" — 7½" gauges
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53 Brentwood Road
Beaurepaire, Quebec, Canada

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Apr. 19, May 3, June 14, July 12 & 26
& 26, Aug. 9, Sept. 20, Oct. 4 & 18
William M. Scott, Secy.
R. D. 1, Box 400
Sellersville, Pa. 18960

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weather permitting
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San Antonio, Texas 78212

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Ave.
Riverside, California
Francis H. Smith, Secretary
5536 Dawey Avenue
Riverside, California 92504
Phone 688-9533 or 683-9628

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Rialto, California 92376

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Every Sunday
12" gauge
Grand and First Streets
0.4 miles south of Post Office
Stanton, Missouri

PART TWO

PLUMBING

SO YOU WANT TO BUILD A LIVE STEAM LOCOMOTIVE

CHAPTER 13

by Joseph F. Nelson

SOLDER-JOINT COPPER TUBE FITTINGS

These fittings are relatively inexpensive, and are also easy to use in a system since they may be either silver soldered or soft soldered to copper tubing. They have one disadvantage for use on the small Live Steam locomotive: their minimum tube O.D. size is ¼", and the minimum pipe thread size of the adapters is 1/8". However, where they can be used, they are easy to install, present a neat appearance, and help keep the cost down. They can be purchased at the refrigeration and plumbing supply houses.

45° BRASS FLARED TUBE FITTINGS

These fittings are made in all configurations of "pipe x tube" and "tube x tube". They start at a minimum of 1/8" flared tube and 1/8" pipe thread. They are satisfactory for the highest pressures used on Live Steam locomotives with the advantage that they are readily obtainable at automobile, hardware and refrigeration supply outlets. They are especially useful where joints must be made up and broken frequently, such as water and oil hoses between the locomotive and tender.

37° FLARED TUBE FITTINGS

These are the old AN (Army-Navy) fittings, now called MS (Military Standard), and are identical to, except for tolerances, the J.I.C. (Joint Industrial Congress) hydraulic standards fittings. They cover the complete range of shapes and sizes from 1/8" flared tube and 1/8" pipe thread on up. They are made in aluminum, brass, steel, and stainless steel. The joint can be made up and broken with no wear on the tube flare since the sleeve takes the brunt of the twist when setting up the nut. This is an important factor in high pressure pneumatics and hydraulics, but for the low pressures used in the Live Steam locomotive, it is of no particular significance. They are manufactured by Aeroquip, Parker, Imperial, and other concerns. Military surplus hardware outlets are good but somewhat undependable sources for the MS fitting. The J.I.C. fittings are sold as complete assemblies, but the MS fittings are sold broken down into separate items – fitting, sleeve, and nut. There have been many improved fittings brought out over the years, but, for one reason or another, in spite of claims, are not in general satisfactory for use on Live Steam locomotives with soft copper tubing.

TUBING TOOLS

To properly work tubing for the plumbing in the various systems of a Live Steam locomotive, certain tools should be obtained so that a neat and workmanlike job of plumbing will result. The basic tools are a tube cutter, a flaring tool, and a tube bender for the different tube sizes that will require bending. Since the average builder isn't going in for production, it would be a waste of money to purchase the more sophisticated tools for a "one time job."

TUBING CUTTER

A tubing cutter should be used to cut the tubing off square. It must be realized that after the tube has been cut, the burr on the end of the tube must be removed so as not to cut down the flow through at that point. Also, where the tube must be flared, the burr must be removed to create a lead-free flare. Most tubing cutters have a burring blade built into them. Any of the low priced tubing cutters manufactured by Imperial Brass will do a good job.

FLARING TOOL

This tool is also made by Imperial Brass. The lowest priced 45° flaring tool, Model 193-FA which will flare 1/8" to 1/2" O.D. tubing will be satisfactory for general use. The 45° flaring tool can be used in place of the 37° flaring tool on annealed copper tubing since when a joint is made and the nut is pulled up tight, it will be found that a good flare has been formed. The same is true when a 37° flare is reformed to a 45° flare. Under no condition attempt to flare stainless steel tubing with the standard flaring tool since a very high percentage of split flares will result. Where it is necessary to flare stainless steel tubing, a roller action flaring tool is required. Also, the correct angle of flaring tool must be used (37° or 45°) since ductile as stainless steel tubing is, it will not reform to the other angle when tightened in a fitting.

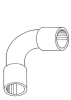
TUBE BENDER

This problem is somewhat more complicated than the purchase of a tubing cutter or a flaring tool. This is because the tube benders that handle more than one size and are made in the larger sizes are rather expensive. Imperial Brass makes a series of benders that will bend tubing as small as 1/8" O.D.; Imperial part 364FH lever-type bender (tubing O.D.). Since 1/8" O.D. tubing may be bent with the bare hands, and 3/16" O.D. may be bent on the 1/4" O.D. bender without deformation, it would be wise for the builder to keep the different sizes of tubing to a minimum. A different size bender will be necessary for each different size tubing, and in addition to the different O.D.'s of tubing, each size of tubing has a minimum approved bend radius. For those wishing to build their own bender, the following radii apply:

Tube O.D.	Radius to center of tube	Tube O.D.	Radius to center of tube
1/8''	3/8'' min.	3/8''	15/16'' min.
3/16''	7/16'' min.	7/16''	1-1/2'' min.
1/4''	9/16'' min.	1/2''	1-5/8'' min.
5/16''	11/16'' min.	5/8''	2-1/4'' min.

The above minimum bend radii are based upon the minimum bend radii of tube benders listed for soft metals by Imperial Brass. The more sophisticated benders listed by Parker and Imperial consistently give a larger bend radius for most tubing diameters.

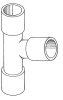
Many people have tried the external spring-type tube bender and many mechanics have them in their tool boxes, but they are never used except as a ''last resort''. Then only a mediocre bend is to be expected.



SHORT RADIUS 90° ELBOW

LONG RADIUS 90° ELBOW

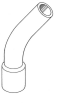
45° ELBOW



WROUGHT TEE

90° STREET ELBOW

90° STREET ELBOW



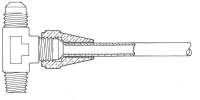
45° STREET ELBOW

MALE ADAPTER

SOLDER-JOINT COPPER TUBE FITTINGS

90° ELBOW

45° ELBOW



TEE WITH UNION NUT

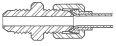
NOTE: A wide selection of these fittings is available in all configurations.

BRASS FLARED TUBE FITTINGS - 45°

90° ELBOW

SLEEVE

90° ELBOW



UNION WITH SLEEVE AND NUT

NOTE: These fittings are MIL. Spec and are to J.I.C. Hydraulic Standards. They are available in brass, steel and stainless steel.

FLARED TUBE FITTINGS - 37°

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15" – 16" – 24" – 36" Gauges

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TENDER BEADING TECHNIQUES

On sheet metal parts where a beaded edge is required, I have used a quick way to slit copper tubes to use for the beading. The tube is first sawed a little longer than required and an inch-long slit is sawed in one end of the tube. A music wire is then fed through the tube, leaving enough to fashion a stop on the end of the wire opposite the slit end of the tube. (I use a nut for a stop, wrapping the wire through it several times.) Then draw the wire through the slit and clamp about ¾" of that end of the tube in the vise. This will leave the wire coming out of the slit but will not be clamped in the jaws. Now grip the wire firmly with pliers and pull. The wire will cut a slit – crooked – bit of uniform width the full length of the tube.

RICHARD M. HUMPHREY
2051 BALI ROAD
COCOA BEACH, FLA. 32931

Cole's Power Models in Ventura, California, stocks a beautiful small brass channel 1/16-inch across the base and with an internal groove just perfect for starting on 1/32-inch material. This makes beautiful beading and goes on very easily without doing any milling.

WALLACE C. RUDD
8 HIDDEN GREEN LANE
FAIRCHMONT, N. Y. 10538

THE FUTURE OF LIVE STEAM

Reading the article by John Matlock, I cannot help but agree that the future of Live Steam modeling is great if it can be publicized and promoted.

Most present-day young modelers don't have a hope of acquiring a work shop necessary to build one of these models. While my workshop may not be the dream kind, I have been fortunate in meeting the shop teacher at the local high school and usually one night each week have the use of the shop for milling, grinding, drilling, brazing, etc. It may pay prospective modelers who don't have a full workshop to try contacting their local high school shop teacher. You may be surprised at the interest and help that you will get. If you have never run a lathe or other machine tool in your life, these schools usually offer a night course on basic machine shop work that can be had at low cost and give you the basic skills required.

I have had no machine shop training other than a four-month evening school shop course and am in the middle of building a 3½" gauge 0–6–0 tank loco. My only other experience in this modeling was a vertical single cylinder steam engine built from Stuart Turner castings on a "Unimat", an ideal apprenticeship on improvising on the use of small tools. My shop is now a little larger and progress, while slow, is sure.

NORMAN BARKER
8 PIXLEY CRESCENT
WEST HILL, ONTARIO, CANADA

THOUGHTS ON HEAT TRANSFER

I got to thinking about Doug Alkire's proposals on boiler materials and it seems that some basic principles of heat transfer should be reviewed in that light. Mr. Alkire gives heat transmission figures (LS 7/68) for copper and stainless steel and thereby proposes that a stainless shell to keep the heat in and copper heating surfaces for quick steaming are ideal. The real advantage of stainless for a shell, backhead, throatplate is its weldability. Period.

Remember, heat transfer occurs because the mediums on opposite sides of the separating barrier are of two different temperatures; also the heat absorbing – or dissipating – properties of the two mediums.

Some years ago we had problems on the job involving insufficient cooling of quench oil in a continuous hardening set-up; the city water used in the heat interchangers was too warm to carry off the necessary BTU's. Naturally, the heat exchanger people were called in and I took this opportunity to suggest that tubes in the interchanger be made of copper instead of steel. This didn't cut much

ice! According to the expert, if the tubes are thin, the material does not make a significant difference. In other words: for efficient heat transfer, keep the material thin and have plenty of surface.

The other consideration involves the mediums' giving up or receiving of heat. Good old *aqua pura* has a specific heat of 1 and you will find few materials to top this, which is one of the reasons why steam works so well for us. The new antifreeze experimenters using a closed system with say Freon will need much more heating surface than if steam were used.

Air, on the other hand, has a very low specific heat and is a poor conductor, also! So using a low conductance material for a boiler shell to cut heat losses would not be a significant advantage. First, 70° ambient temperature and 300° steam gives a differential of 230° with air being the medium receiving the heat. On the other hand, consider 150° ambient temperature and 300° water gives a 1200° differential with water taking up all those BTU's. We see that heat transfer inside overshadows by a considerable margin any heat loss from the shell – even if the shell is copper. Our late, lamented Curly (LBSC) did not lag his boilers and I'm sure that if lagging made a significant difference he would have insisted on it. Curly's boilers (does anyone know how many he built?) were copper.

So to put all the foregoing together, use the same material throughout your boiler. Heat losses to the air will be insignificant. Preferably use copper for ease of working, corrosion resistance and freedom from stress cracking. Not the least advantage of copper is that if the crown sheet should be uncovered inadvertently, the material's high heat conductance will prevent a hot spot in the crown sheet.

P.S. Happiness is a big lump of genuine Welsh coal in your stocking on Christmas!

WILLIAM I. TREADWAY
352 BREWSTER ROAD
BRISTOL, CONN. 06010

WOULD-LIKE-TO-SEE DEPARTMENT

... an article about the necessary care and maintenance required to keep a Live Steam locomotive in good running condition. I believe this would be of great interest to those who would like to purchase a Live Steam locomotive but would first like to know what they must do to maintain it.

SCOTT LEFEVER
135 STRASBURG PIKE
LANCASTER, PA. 17602

The Extra Board

Fifteen words or less not including name or address: $2.00 in advance, 10¢ per word for additional copy. No commercial ads of any kind accepted for this column.

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